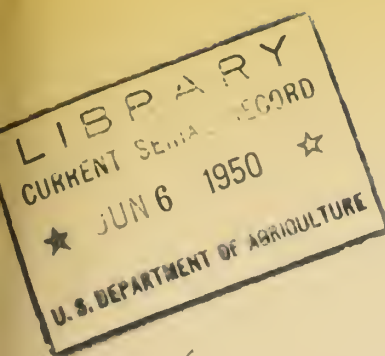


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UNITED STATES DEPARTMENT OF AGRICULTURE  
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Bureau of Plant Industry, Soils,  
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X SHIPPING TESTS WITH WASHINGTON NAVAL ORANGES, COMPARING VENTILATION  
BEHAVIOR OF THE 561- AND THE 462-BOX LOADS FROM SOUTHERN CALIFORNIA,  
JANUARY AND FEBRUARY 1950 X

(In cooperation with the California Fruit Growers Exchange)

By

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### INTRODUCTION

Six series of controlled-ventilation shipping tests with Washington naval oranges were made from Central and Southern California during the period December 1944 to February 1947. All test loads studied were of 2-1/2 layers, or 561 boxes, to meet the wartime loading rules of the Office of Defense Transportation. This heavy load prevailed from that time until November 24, 1948, when permission was granted to return temporarily to the prewar standard two-layer load of 462 boxes. The heavy load regulation itself was cancelled June 30, 1949. With few exceptions, orange shippers were quick to take advantage of the release from heavy loading by returning to the 462-box load.

The change in size of the orange load should call for little or no modification in recommendation for refrigeration service, but effect of this change on ventilation became a matter of question. It seemed possible that the smaller load with the increased space for air circulation might require some modification of ventilation procedures for safety from freezing. In any case, it was thought that the two types of orange loads ought to be compared with respect to ventilation behavior.

The purpose of the small series of ventilated shipping tests reported here was to make comparison of the two sizes of orange loads as stated above. The tests were run during the period January 25 to February 28, 1950.

### PLAN OF TESTS

1. The series of tests consisted of five pairs of cars; one of each pair carrying a 2-1/2-layer (561 boxes) load, and the other a 2-layer or 462-box load. The shipping route was via the Santa Fe and Erie railroads from Southern California to New York.

All test cars were equipped with air circulating fans which were placed in the operative position, even for ventilation service. Both cars of a pair were always of the same series and, although three different series of cars were used in the tests, all were in good condition and of modern construction.

2. Each car carried three Ryan recording thermometers inside boxes of fruit located in the load as follows: (a) bottom and (b) top layers, centerline at quarterlength (8th stack) and (c) top layer, centerline at

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<sup>1/</sup> Grateful acknowledgment is made of the cooperation of the orange associations furnishing the test loads and the Santa Fe Refrigerator Department.

Other persons participating in the tests were J.P. MacRill, J.A. Scanlon and Robert Swanson of the California Fruit Growers Exchange, and Harlan Barber of the U.S.C.A.



bunker. These boxes were placed in the air-intake end of the car, which in STRD cars is the rear end, with reference to the direction of movement en route. With fans in operation the top-bunker position should be somewhat the coldest location in the load during ventilation in cold weather.

In addition to the three Ryan thermometers mentioned, the 561-box car of each pair also carried a thermometer attached to a beam underneath the floor near the doorway, for recording outside air temperatures.

3. No special test boxes were prepared for these tests, but inspection data on commercial loads were furnished by Mr. J. A. Scanlon of the C.F.G.E. in New York.

4. The Ryan thermometer temperature records were supplemented by fruit temperatures at doorways obtained manually at Belen, N. M. and similarly again at destination, with the addition of quarterlength position temperatures.

## RESULTS

### 1. Outside temperatures encountered in transit.

The shipping tests were unfortunately delayed into late January on account of the small volume movement of navel oranges out of Southern California to the eastern markets during the first half of the month. This delay caused the tests to miss some of the lower transit temperatures which were needed to accomplish the full purpose of the tests. The general temperatures encountered were satisfactory for ventilated shipments as such, but, for the kind of information sought in the present case, somewhat colder weather should have been better. The outside air and the load temperature records for each test are shown in figures 1 to 5, inclusive.

### 2. Notes on individual tests.

Test 1. RD 9808 - 561 load - National Orange Co.  
RD 8861 - 462 load - Victoria Ave. Citrus Assn.

Both cars billed "vents open to Belen"; blind pack, fans sealed "on".  
Loaded 1/25 (loading Temp. 64° and 58°, respectively.)

Arr. Belen 1/28; unloaded N.Y. 2/5.

Doorway temperatures:	Belen:	561 load;	Top 38°;	bottom 42°.
		462 "	" 31°;	" 36°
	New York:	561 "	" 37°;	" 35°
		462 "	" 36°;	" 35°

The rather low outside temperatures encountered during the first three days caused rapid cooling of the loads to about 40°. After Belen the temperatures were too low to permit the vents being open so that there was

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1/ Paired temperatures always given in the order: 561- and 462-box loads.





little further cooling. Average transit temperatures of the loads were 40.8° and 42.9°. Elapsed time from loading to unloading, 11 days.

From the inspection report, both cars contained sound fruit but there was a slight difference in the appearance of the samples that were taken from each car. This difference in appearance could not have been charged to conditions encountered during transportation.

Test 2. RD 15305 - 561 load - La Verne Orange Assn.  
RD 15130 - 462 load - San Dimas Orange Growers.

Both cars billed "combination ventilation"; blind packs, fans "on".  
Loaded 2/2 (loading Temp. 62° and 64°).  
Arr. Belen 2/5; unloaded N.Y. 2/13.

Doorway temperatures: Belen: 561 load; Top 49°; bottom 51°.  
462 load; " 46°; " 50°  
New York: 561 load; " 38°; " 37°  
462 load; " 38°; " 36°

The cars loaded rather cool and the outside temperatures were very favorable for even standard ventilation for the entire trip. The average transit temperatures of the loads were 42.0° and 43.4°. Elapsed time from loading to unloading, 11 days.

From the inspection report, condition of the fruit similar in both lots (cars). Both were sound and firm with fresh green buttons.

Test 3. RD 10545 - 561 load - McDermont Fruit Co.  
RD 10568 - 462 load - " " "

Billed: "Vents open to Belen"; blind pack, fans "on".  
Loaded: 2/7 (loading Temp. both cars 72°).  
Arr.: Belen 2/10; unloaded N.Y. 7/19.  
Doorway temperatures: Belen: 561 load; Top 40°, bottom 46°.  
462 " " 30° " 30°  
New York: 561 " " 38° " 38°  
462 " " 39° " 37°

These cars loaded rather warm and the outside temperatures were high enough that the load temperatures did not reach 50° until the second day after loading. However, on the third morning just before and at Belen the cars encountered low outside temperatures having a minimum of 19° which quickly reduced both loads into the upper 30's. Average load temperatures for the trip, 43.4° and 44.6°. Elapsed time from loading to unloading, 12 days.

From the inspection report, fruit in both cars was sound, mostly firm to considerable pliable and was practically similar in appearance.

Test 4. RD 9290 - 561 load - Monte Vista Citrus Assn.  
RD 9533 - 462 load - National Orange Company.

Billed: "Vents open to Belen"; full wrapped pack; fans "on".  
Loaded: 2/16 (loading Temp. 69° and 69°).  
Arr.: Belen 2/19; unloaded N.Y. 2/26.



#### Test 4 (Cont'd)

Doorway temperatures: Belen: 561 load; Top 40°, bottom 53°  
462 " " 33° " 42°  
New York: 561 " " 42° " 38°  
462 " " 42° " 37°

These cars loaded rather warm and did not encounter temperature low enough to reduce loads to 50° until the morning of the third day en route, when a minimum of 21° occurred near Belen. Five days of continuous sub-freezing weather, soon after changing to standard ventilation at Belen, kept the vents closed to New York. Average transit load-temperatures were 51.4° and 51.3°. Elapsed time from loading to unloading, 10 days.

From the inspection report, the appearance of the fruit was similar in both cars. Each was firm and bright, with fresh green buttons.

Test 5. RD 9349 - 561 load - McDermont Fruit Co.  
RD 9578 - 462 load - " " "

Billed: "Vents open to Belen"; blind pack; fans "on".

Loaded: 2/18 (loading Temp. 64° and 65°).

Arr: Belen 2/22; unloaded N. Y. 2/28.

Doorway temperatures: Belen: 561 load; Top 46°, bottom 50°  
462 " " 36° " 38°  
New York: 561 " " 38° " 36°  
462 " " 37° " 35°

Outside temperatures in transit were too high until near Belen to allow satisfactory cooling. During the last six days the temperatures were low, showing one minimum of -3°, probably in the vicinity of Chicago. Load temperatures then decreased into the upper 30's. The average transit load temperatures were 51.4° and 50.7°. Elapsed time from loading to unloading, 10 days.

From the inspection report, both lots were similar in appearance and condition. The fruit in each car firm and sound, with fresh green buttons.

#### CONCLUSIONS

The purpose of the series of tests here reported was to compare the behavior of the 561- and the 462-box loads in ventilated shipments to determine whether or not some modification need be made of ventilation procedures for the lighter load.

The comparative results obtained showed so little difference between average temperatures of the two types of load that no need of modification was indicated. However, information yielded by these tests should not be considered conclusive, for the reason that the outside temperatures during the first three days of transit probably were not low enough to cause the maximum difference in cooling of the two load-types.

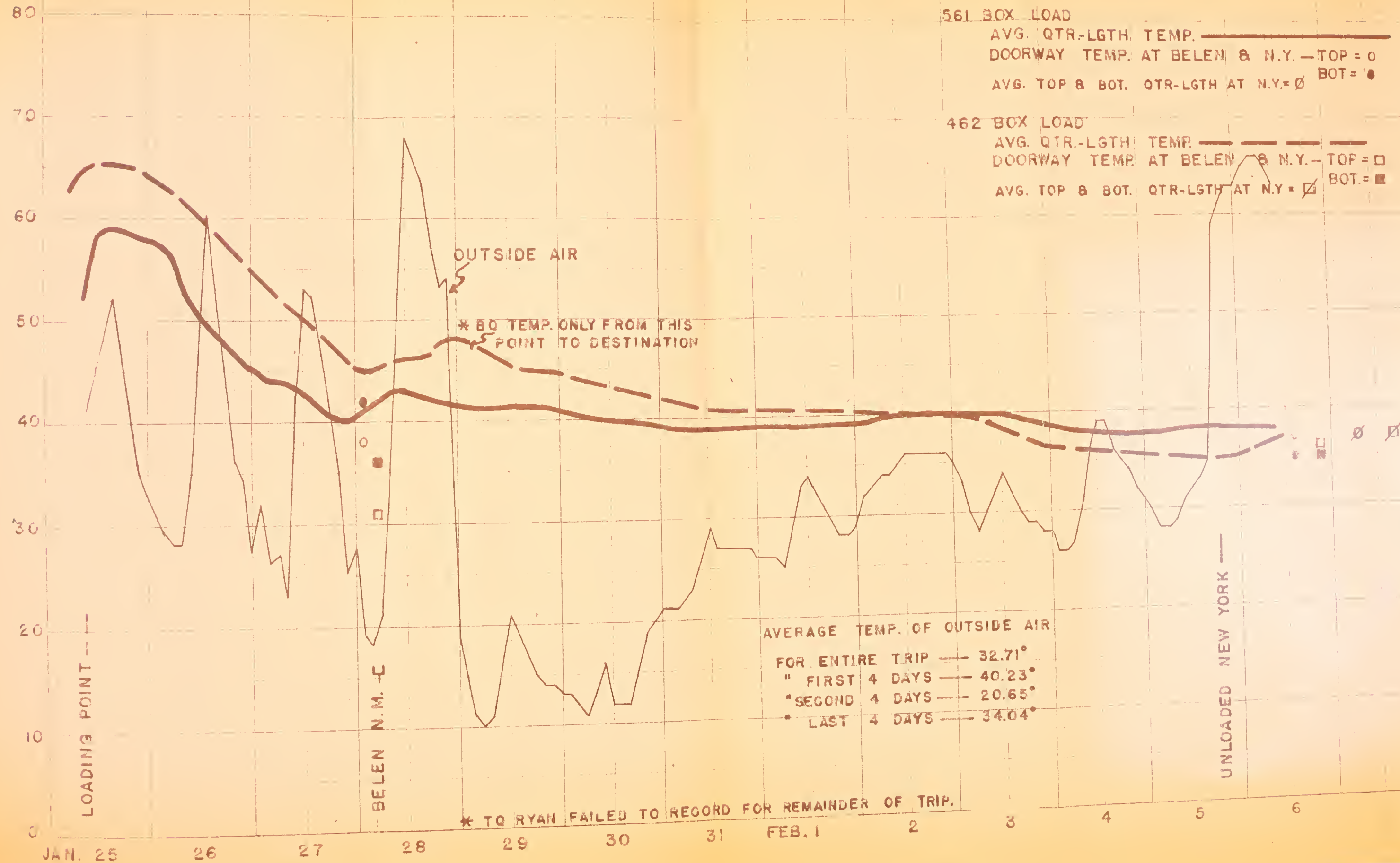
For more decisive information additional study should be made with ventilated shipments originating in Central California. Also at the same time some comparison could be made of the relative performance of icing services with the two types of load.



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FIGURE 1

## COMPARISON OF TEMPERATURES IN CARS OF NAVAL ORANGES WITH 561 &amp; 462 BOX LOADS







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FIGURE 2

# COMPARISON OF TEMPERATURES IN CARS OF NAVAL ORANGES WITH 561 & 462 BOX LOADS

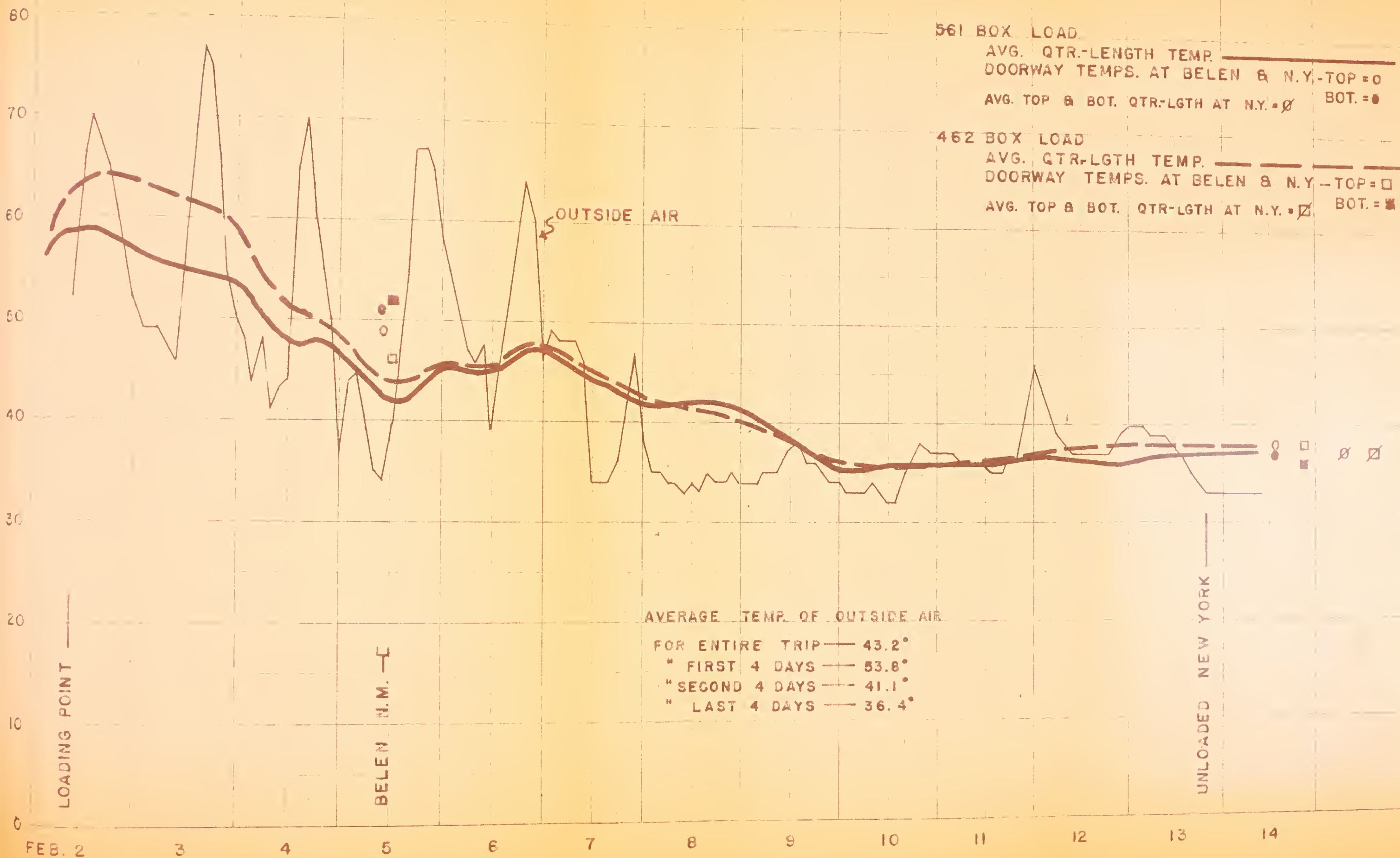






FIGURE 3

# COMPARISON OF TEMPERATURES IN CARS OF NAVAL ORANGES WITH 561 & 462 BOX LOADS

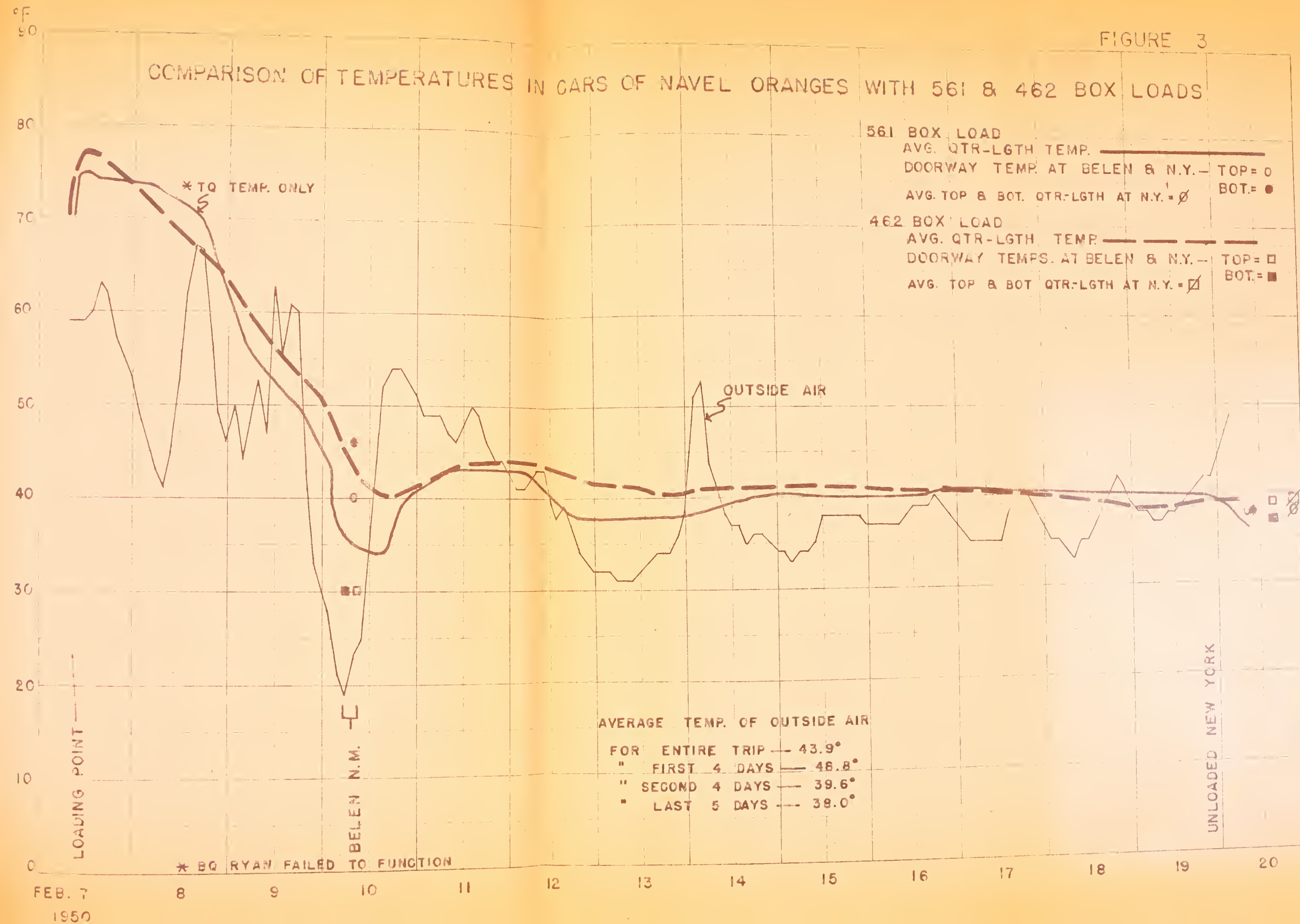
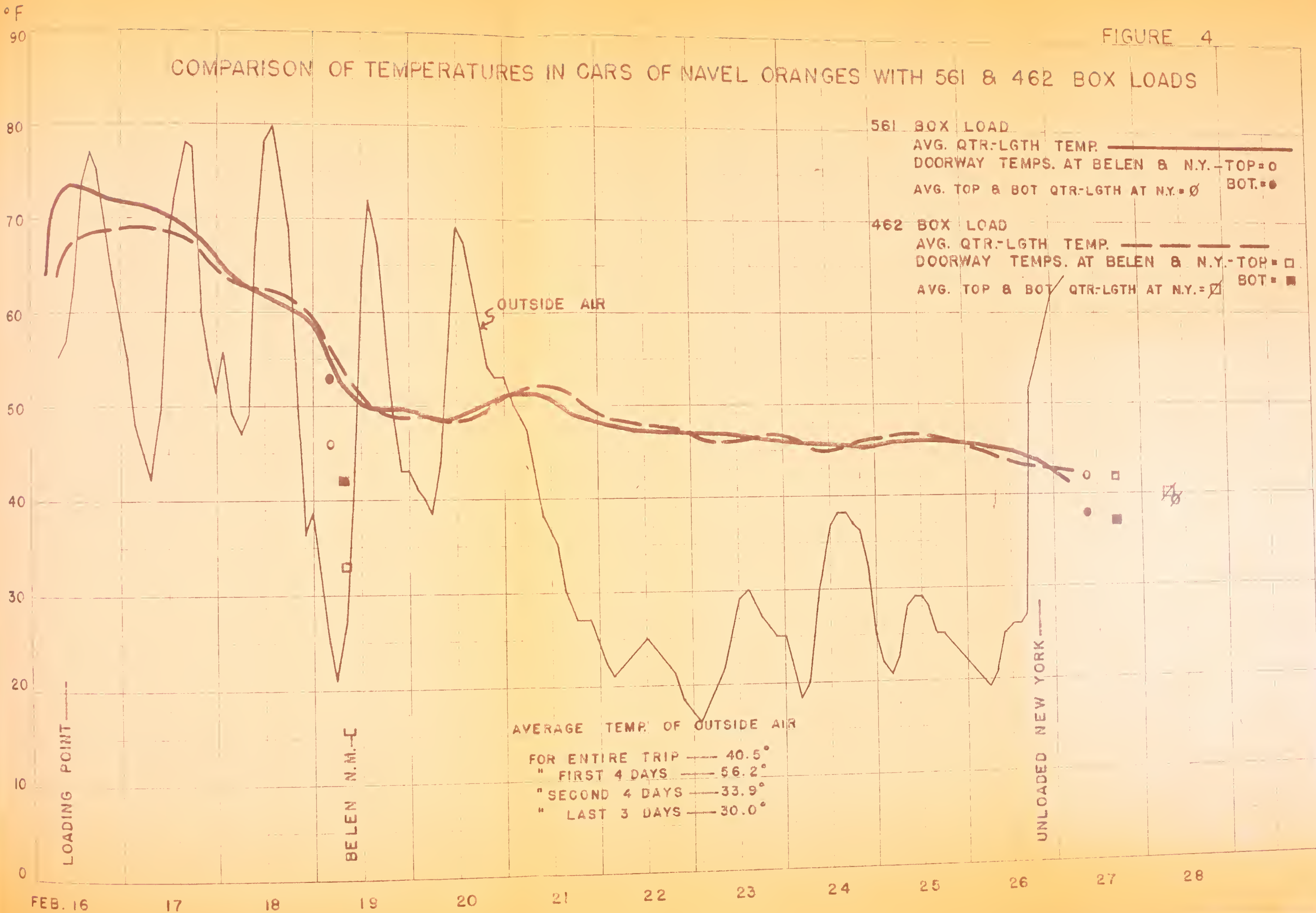




FIGURE 4

COMPARISON OF TEMPERATURES IN CARS OF NAVEL ORANGES WITH 561 & 462 BOX LOADS







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FIGURE 5

## COMPARISON OF TEMPERATURES IN CARS OF NAVEI ORANGES WITH 561 &amp; 462 BOX LOADS

